Planning Students' Experience of Geometric Modeling: Attitudes Towards the City

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ABSTRACT
Design-based solution approaches should have a conceptual background, regardless of the profession. Following the conceptual background makes the design universal and saves it from subjective to objective perspectives. Nowadays, especially the spatial planning designers started to move away from this conceptual flow and the stages of the design process due to the proliferation of inputs and the complexity of the spaces. Therefore, the importance of abstraction and geometry should be emphasized more in design education. In this study, a method is discussed to understand urban space and the individuals who use the space by using abstraction in the City and Regional Planning 1st Year Basic Design education. Abstraction is a concept used to understand the most basic reality of a phenomenon or event and is a critical method to understand complex systems and reach core knowledge. In basic design education, from the beginning of the education process, it is aimed to provide students with the understanding of looking at problems with an abstraction approach, and all studies are designed to mentally prepare students for the final project. Before starting the final project, a workshop was organized where they could brainstorm over all this knowledge. Also, scenarios were discussed on social groups with different attitudes towards the city and the spaces where these groups live. As a result of the workshop, eleven different social groups were identified. Students were asked to prepare scenarios for these groups and abstract the spatial structures using the support of geometry and color. In the final project, it was seen that the students were able to use the concept of abstraction successfully in situations like understanding the problems from a professional point of view and producing the solutions for them.
KEYWORDS: Higher Education, City and Regional Planning Education, Basic Design, Geometric Modeling, Abstraction

ÖZET
Tasarım temelli çözüm yaklaşımları hangi meslek grubunda olursa olsun kavramsal bir arka plana sahip olmalıdır. Bu kavramsal yaklaşımlar tasarım anlayışını evrensel kılar ve öznel yaklaşımlardan kurtarıp nesnel bir boyuta taşır. Bu nedenle tasarım eğitiminde soyutlama ve geometrinin önemi daha fazla vurgulanmalıdır. Bu çalışmada Şehir ve Bölge Planlama 1. Sınıf Temel Tasarım eğitiminde kentsel mekânı ve mekânı kullanan bireyleri soyutlama yardımıyla açığa çıkarmaya yönelik bir yöntem ele alınmıştır. Soyutlama bir olgu ya da olayın en temel gerçekliğini anlamak için kullanılan bir kavramdır ve karmaşık sistemleri algılamak ve öz bilgiye ulaşmak için oldukça önemli bir yöntemdir. Temel tasarım eğitiminde, eğitim sürecinin başından itibaren öğrencilere, problemlere soyutlama yaklaşımıyla bakabilme anlayışının kazandırılması hedeflenmiş ve tüm uygulamalar

öğrencileri final çalışmasına zihnen hazırlamak üzere kurgulanmıştır. Final projesine başlamadan önce tüm bu bilgiler doğrultusunda beyin fırtınası yapabilecekleri bir çalıştay düzenlenmiştir. Ayrıca kente karşı farklı tutumları olan sosyal gruplar ve bu grupların yaşadıkları mekânlar üzerine senaryolar tartışılmıştır. Çalıştay sonucunda on bir farklı sosyal grup belirlenmiştir. Öğrencilerden bu gruplara yönelik senaryo(lar) hazırlamaları ve mekânsal yapıları geometri ve renk kullanarak soyutlamaları istenmiştir. Final projesinde öğrencilerin profesyonel bir bakış açısıyla sorunları anlama ve bunlara çözüm üretme gibi durumlarda soyutlama kavramını başarılı bir şekilde kullanabildikleri görülmüştür.

ANAHTAR KELİMELER: Yüksek Öğrenim, Şehir ve Bölge Planlama Eğitimi, Temel Tasarım, Geometrik Modelleme, Soyutlama

1. INTRODUCTION

Basic design education emerged as one of the most fundamental teachings of the Bauhaus school in the 1920s and its influence in education has continued to spread (Jonas, 1969). The Bauhaus effect has transformed the disciplines of architecture, art and related to design in the world and in Türkiye (Artun, 2009). Tekeli (2001) said because of the Bauhaus effect, the First National Architecture Movement was abandoned in our country and modern, "geometric" architecture became dominant. According to Lynthon (1982), this differentiation emerged with the rapid technological developments that began towards the end of the 19th century, changed the art and thought movements of the period, and developed art movements such as Cubism, Fauvism, Expressionism, Futurism, Dadaism, Ready-Made, Constructivism and Surrealism in the early 20th century. Therefore, industrial and technological developments have brought aesthetic concerns in every field (Bulat, Bulat, & Aydın, 2014). In this process, Bauhaus aimed to ensure mutual interaction by removing the barriers between applied arts and fine arts.

The basic design education given in design-based schools are based on the traces of the Bauhaus school. When the relevant literature is examined, it is seen that practice-based design education is a method that has been accepted from past to present (Green, 2005; Blair, 2006), but different disciplines tend to have different applications. In this context, when the planning discipline is considered, it is seen that basic design education is handled in workshops where theory is transformed into application and practice (workshops, also called studios, are a kind of traditional learning method that forms the basis of many disciplines and where practice is emphasized in the learning process (Knoll, 1997; Pearson, Barlowe, & Price, 1999). It is generally accepted that the way of teaching and learning in these projects develops students' creative spirits by recognizing shapes, colors, rhythm and light, and establishing a personal bond with various materials (Boucharenc, 2006). The basic design education, which is seen as the first step of the project courses especially in the undergraduate period, enables students to understand the design principles correctly by following a conscious process in a short time (Güngör, 1972). From this point of view, this study analyses an application practice of basic design education that focuses on developing the visual perception and communication skills of planning students. Geometric design, which has been used in many fields in recent years, constitutes the final output of this practice, so it will be useful to examine the relationship between design and geometry in this study.

2. GEOMETRY, ABSTRACTION AND DESIGN

Mankind has always imitated nature since its existence, and this has formed the basis of the design phenomenon by formalizing the formations produced by man. In the 17th century, Newton argued that the universe was designed in a completely mathematical order and that everything worked with a mechanical system (Değirmenci, 2009). Euclidean geometry examines the relationship between points, lines in 2-dimensional space and points, lines and planes in 3-dimensional space (Kurt, 2016). Although Newton's approach and Euclidean geometry are considered to be complementary approaches, they actually had a direct or indirect effect in the field of art and design. As a matter of fact, traces of geometric forms showing a certain order can be seen in many disciplines, including

architecture and planning (Değirmenci, 2009). In addition, it is possible to say that fractal concepts, also known as chaos geometry, are included in the field of design as much as Euclidean geometry. Designers, who initially constructed an order by imitating nature, started to use fractal geometry in their designs, arguing that nature actually has an irregular structure (compared to Euclidean geometry).

There is a mathematical connection between natural shapes and fractals and the concept of fractal dimension has been extended to explain natural forms (Peitken, Jurgens, & Saupe, 1992). One of the most important features of fractals is that they have infinite details and each detail has the feature of "self-similarity" (Değirmenci, 2009). In the literature, there are various studies on the construction of a fractal system with basic geometries by emulating this feature. For example, Katunin and Kurzyk (2012) presented fractal geometries generated with polyhedrons as a result of their calculations (see Figure 1).
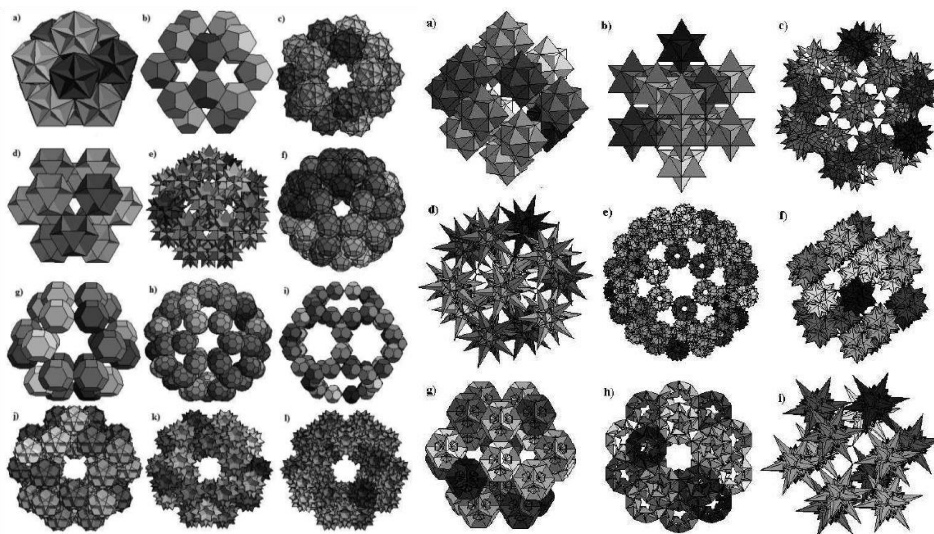

Figure 1. Fractal geometries obtained with polyhedrons (Katunin and Kurzyk, 2012)

All these geometric tools in question basically create the notion of abstraction that many disciplines need. Hançerlioğlu (2005) defines the concept of abstraction as the most competent stage of the process of knowledge. No knowledge of the essence and reality of any phenomenon and event can be reached without the acquisition of abstract concepts. Abstraction is, in fact, a method, a tool, used to get back to the concrete and to grasp the parts of the concrete whole in their relations to each other. According to Hegel, abstraction refers to the reality of being at the beginning of the process of revealing itself and is still in itself. In this sense, it is abstract, pure and simple (Müezzinoğlu, Sungur, & Çınar, 2019).

In order to make a design, the problems in the environment must be correctly defined, analyzed and the core of the events must be understood. Defining, analyzing and reaching the core of the phenomena and the events is only possible through the act of abstraction. The concrete facts and events can only give the formal and external reality, it is the abstraction that gives essential knowledge (Hançerlioğlu, 2005). In this context, Carter (1985) considers Walter Christaller's theory of determining the number, distribution and size of towns in a region (see Figure 2) as a good example (Günay, 2007).
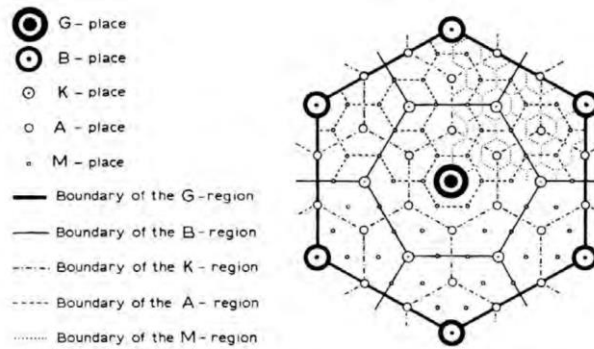
Figure 2. Walter Christaller's abstraction of laws for residential areas (Günay, 2007)

Although two-dimensional abstractions are widely used to create the right perception and strengthen expression, it is observed that design-oriented abstractions also include the third dimension. Three-dimensional perception and abstraction is one of the most difficult stages in the discipline of planning. On the other hand, abstraction using geometry is one of the easiest methods to analyze highly complexly organized cities, and for this reason geometric abstraction is included in the curriculum of most planning schools. Günay (2007) states that creating the urban form is a two- and three-dimensional composition problem and emphasizes that given the shape of the city, the planner should have the ability to create a 'sense of belonging' of building groups to shape the urban environment.

In general terms, the process of abstraction in the act of designing, consists of linking meaning, function and form in such a way that refers to each other. While a form is abstracted, the meaning and function expressed by that form is also abstracted and included in the concept (Müezzinoğlu, Sungur, & Çınar, 2019). Although abstraction in design is the separation of the features that shape the design, it is essential not to break away from the main idea (Kaya & Aytıs, 2019).

3. GEOMETRIC MODELLING PRACTISE

It is a known fact that perceptual differentiation develops in individuals who study design education with the concept of abstraction, for this reason design education is a way of guiding and transformative (Ertürk, 1984). In planning education, it is very important to perceive the problems of complex cities and the individuals living in these cities correctly. From this point of view, in the light of the information obtained from the literature, an answer to the question "Can planning students perceive the city with a geometric abstraction practice?" was sought and it was decided to assess an application within the scope of the urbanism project course. There are various basic design applications made with different geometric forms, but in this study, students were asked to interpret the city with its social, physical and psychological dimensions and to abstract it in three dimensions with the help of geometric modeling.

4. SCOPE AND METHOD OF THE STUDY

The study was carried out with 70 students who studied basic design education in Planning Studio I in the 2017-2018 academic year of Necmettin Erbakan University, Faculty of Engineering and Architecture, Department of City and Regional Planning. Within the scope of the study, it was decided to evaluate the projects through final submissions. Before the final project, during the semester, the students were introduced to Gestalt principles under Bauhaus' educational tradition based on geometric forms (Itten, 1975) and were asked to create numerous abstract and concrete applications in 2 and 3 dimensions. Students questioned the concepts of balance, space, reference frame, scale, proportion, order (structure, network, model) in terms of one-dimensional lines, two-dimensional spaces and three-dimensional volumes and then used this knowledge in the production of space. In addition, instead of only classical Euclidean geometry, fractal geometries and different geometries and ratios in nature were included in the teachings within the scope of various

in-class activities before the final project. Since the students' final project will enable them to understand the society they live in, the natural and built environment, their skills were selected from the literature on the city and space, and their vocabulary were developed through various readings. The study of planning requires being prone to teamwork, students were invited to work in teams of at least 5 people and the studio was divided into 11 groups (groups of 5, 6 or 7 people). Thus, the individual development of the student was observed and also his/her experiences of taking part in the group and working collaboratively.

4.1. Study Subject and Application Phase
The subject of the studio course is the geometric modeling/representation of the individual differences that exist in society, and the social groups that appear from these differences by abstracting them. In the application phase, first of all, intellectual activities were carried out with the students on the study topic. As a result of the discussions focused on the "human element" that constitutes society, students named different groups and predicted what the behaviors of these different groups would be towards the city. After this abstract intellectual activity, in order to concretize their thoughts, the student groups, each of whom chose a different behavioral topic, were asked to prepare a written report (prepared jointly), and a number of scenarios were prepared in accordance with these reports.

4.2. From Scenario to Design...
From the scenarios prepared in great detail, the abstraction and design phase started again. Scenario content includes keywords, slogans with the study topic and colors that evoke groups in accordance. Five basic principles were identified to guide students in their designs. These principles are as follows;

a.   A module consisting of at least two units should be designed for the study.
b.   Each unit and module designed should be related to the scenario and key concepts. Each geometry chosen should express both social and spatial structure and the design should be shaped accordingly.
c.   Colors should be chosen accurately expressing the attitudes of the individual/group/society towards the city.
d.   The prepared modules should be designed in a certain order using repetition, movement and ratio-proportion.
e.   With modules and units an order based on Euclidean geometry or fractal geometry should be achieved.

5. FINAL DESIGN (ATTITUDES TOWARDS THE CITY) AND FINDINGS
In the intellectual exercise, many personality traits such as justice-oriented, fair, hardworking or lazy, productive, active-passive, socially excluded, compatible or incompatible, individualistic, egoistic, happy, hopeful, conservative, optimistic, prudent, brave-fearful, oppositional, fatalistic, futuristic, traditional, warrior, destructive, depressive, etc. were listed. When the attitudes of these individuals towards the city were discussed, the students created new groups and scenarios by combining some or one of the personality trait listed above. The attitude headings created were as follows.

1.   Fair attitude
2.   Productive attitude
3.   Incompatible attitude with the city
4.   Individualistic (selfish) attitude
5.   Optimistic, hopeful about the future attitude
6.   Protective, conservative attitude
7.   Collective, harmonious attitude
8.   Aimless, fatalistic attitude
9.   Activist attitude
10. Futurist attitude

11. Destructive attitude

After determining the attitudes and writing the scenarios, students were asked to find an answer to the question "What are the colors that evoke these attitudes?". As a matter of fact, colors are one of the main components of design. It is known that colors that strengthen the imagination also have various psychological effects that reveal negative or positive emotions (Özdemir, 2005). In fact, color is a form of communication that cannot be expressed in words, and has a language with meanings. Colors can sometimes have different meanings that may vary from culture to culture. For this reason, this study examined the "language of colors" literature that coincide with Turkish culture.

The fair attitude group, which considers each individual, preferred white color in their designs. In literature, white color represents greatness, justice and strength, innocence, purity and cleanliness (Çalışkan and Kılıç, 2014). Yellow, which is considered sacred for Eastern societies, a color of joy and pleasure. The productive attitude group preferred yellow color because it reminds us of the color gold. As a matter of fact, productivity brings happiness and profit. Incompatible attitude with the city group color is dark orange. The representation of orange color is excitement and happiness, dynamic, attention-grabbing, attractive, striking, heartwarming, vitality and courage (Sharma, 2007). A dark-toned orange reflects irritability more (Stout, 2005). The extreme individualistic (selfish) attitude group preferred the red color and drew attention to its negative meaning and expressed that it contains elements of egoism, self-satisfaction, acquisition and ownership (Üster, 1996). The green color reveals positive emotions in individuals. Optimistic, hopeful about the future attitude group used green in their designs due to its soothing, peaceful, healing (Sharma, 2007) effect on the nerves. As the green color gets darker, it is seen that negative emotions are attributed to the color in the literature. As a matter of fact, darker shades of green can be depressing and sometimes debilitating (Sharma, 2007). The overly protective, conservative attitude group also preferred the dark green color in their designs, anticipating that it would contain negativity. The blue used by the collective, harmonious attitude group is similar to green in terms of its characteristics, it is the color of silence, calmness and peace (Mazlum, 2011; Çağan, 1997). The Aimless, fatalistic attitude group preferred dark blue (navy blue) color, because light shades of blue create a peaceful environment, while dark shades represent a depressive environment (Mazlum, 2011). Fatalism and aimlessness bring depression. The activist attitude group identified the purple color with rebelliousness and self-confidence (Kılınçarslan and Fidan, 2012). The futurist attitude group used the metallic gray color in their designs, as the future is represented by this color in the visual media. The black color often evokes negative emotions such as fear, death and hopelessness (Akkın, Eğrilmez and Afrashi, 2004; Kılınçarslan and Fidan, 2012), therefore the preference of the destructive attitude group is black.

The final stage of the final design is the assembly of modules (polyhedrons) created with units selected from regular polyhedrons that can provide continuity for the abstraction of attitudes. These modules, together with attitudes towards the city, scenarios and colors, form different design patterns (see Figure 3)

Fair Attitude Scenario

In this study, the approach to the city with a fair attitude is discussed in terms of the individual and the institution. At this point, an individual with a fair attitude is defined as an honest person, who advocates balance in society, who does not marginalize, who has high empathy skills, and the institution is defined as a fair approach that is far from urban segregation according to the structure it represents, does not displace the citizens, and considers all disadvantaged groups in the decision process.

The modules created by combining polyhedral geometric units with strong connections, where proportional harmony is observed in the work, also symbolize honesty and balance.

Productive Attitude Scenario

In this study, productivity is defined as the power to transform inputs into outputs by imagining a functional attitude, away from visual and aesthetic concerns. At this stage, each new production is considered as a process that builds on and develops upon the previous knowledge, and its reflection on the urban space and the citizens is evaluated from this perspective. In the first stage, a polyhedron emerging from basic geometries such as triangles and squares was combined with other polyhedral units created by adding a new geometry to these polyhedra at each stage in proportional harmony and modules were created. These modules are designed to move while maintaining proportional harmony and strong connections.

The study is based on the philosophy that the basis of production on earth depends on the sun, that the sun and the energy from the sun are the main factors in the life of living things, the fertility of the soil and the technological cycle.

Incompatible Attitude Scenario with the City

In this study, incompatibility is defined as individuals who approach the problems negatively and distantly instead of solutions, who cannot offer alternatives to solution suggestions, who are in constant meetings but cannot reach a conclusion, show a different adaptation to an environment than others. At this point, the regions where low-income groups are located in the cities, the regions where people from rural areas are concentrated, and sometimes the regions where groups coming from different cities or countries are concentrated were examined as sample areas. In addition, buildings or structures that do not
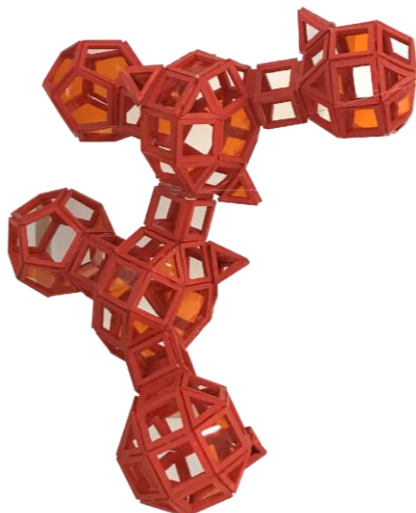
physically adapt to the city within the built environment were also discussed.

In the study, it is shown how polyhedra, which express urban fiction, and regular tetrahedra, which express incompatible groups, come together.

Individual (Selfish) Attitude Scenario

In this study, selfishness is defined as placing one's personal interests at the center of the entire system in the universe and thinking that this placement is the natural right of the individual - related to being human. Based on the understanding that there is no society without the individual, it has been evaluated as a Cartesian (separatist) attitude instead of a holistic one. In this framework, it was found that selfish attitudes are higher in the urban environment by making a rural - urban comparison in nature - human relations and interaction. The social gathering is more attainable in rural areas, however the life in the city is more individualized and these ways of life is affecting the space of the city.

The triangular units formed at the ends of the project express the versatility of both the individual and the space, while the closed polyhedral forms in the center express the closed attitude of the individual (closedness in individual living spaces).
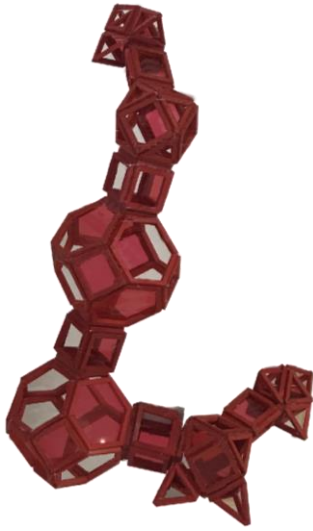
Hopeful for the future, optimistic attitude Scenario

In this study, hope is evaluated through sustainability and a strong relationship with the natural environment, and a social urban approach is adopted that emphasizes the tendency to participate in decision-making mechanisms.

The work was inspired by the hope that nature instills in people and the color green was preferred. Each polyhedron expresses the natural areas in the city at different scales, and the existence and proliferation of these natural areas in the city are expressed through the repetition of the module consisting of three different units. This also reflects a city with high quality of life, many sub-centers, and high accessibility.
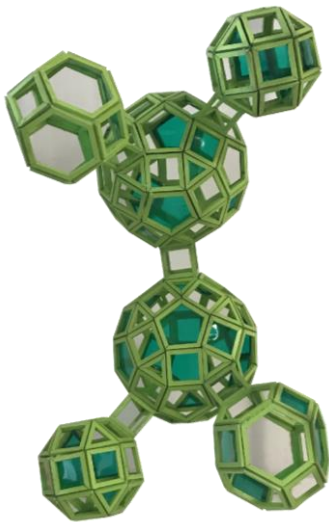
Protective, Conservative Attitude Scenario

The protective-conservative attitude group, which deals with the role of the cultural characteristics of the society in shaping and changing the physical space within the time dimension, has been evaluated with an approach that concerns innovation and nurtures the status quo or opposes change.

In the study, the polyhedral modules, which are interconnected by strong bonds and develop from a single focal point, show similar characteristics to each other. The protective, conservative attitude, which plays an active role in preserving cultural memory and identity and ensuring the continuity of its traces in physical space, brings with it negativities with overprotective approaches so the design is monotonous.
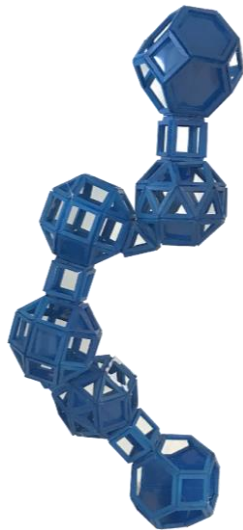
Collective, Harmonious Attitude Scenario

The collective and harmonious attitude is built on "we" and is often defined as the opposite of individualism and expresses all kinds of togetherness as a behavior. The approach, which reveals that the element constituting harmonious attitude is related to its ontological existence, examines the argument that productivity can increase through collaborative actions in the context of individual, natural, and constructed environmental relationships.

In the study, which focuses on a point where polyhedra of the same size, consisting of different geometric units, are compatible with each other, the harmony of different groups in society is emphasized with modules connected to each other with strong ties.

Aimless, Fatalistic Attitude Scenario

In this study, fatalistic attitude refers to those who do not like to take risks, based on the argument that the actions taken against change will be insufficient, and thus the aim of protecting themselves against the possibility of success and failure in every business. The fatalistic attitude is an attitude that is afraid of making mistakes and closed to learning, which differs politically from the conservative attitude that has a policy of returning with the preferences one has. The fatalistic attitude reflects a lack of stability and strategy. The relationship between the individual and the living space is examined within the framework that does not recognize the environment in which he/she lives perfectly and does not aim to

change or renew the environment in which he/she lives. Infinite repetition is possible in design.

Activist Attitude Scenario

In this study, the concept of an activist is defined as a set of active and proactive behaviors that are action-oriented, involved in decision-making mechanisms, and believe in their transformative power. Activists are defined as people who engage in activities to bring social or political change and bring awareness to problems.

In the study, activists who are active in the spheres of society are shown with triangular pyramids placed around the modules. Activists, who act according to their ideas, make progress towards the better by developing different aspects of the city in this design. The starting point of this scenario is creating a livable environment and humane housing conditions in cities.

Futurist Attitude Scenario

In this study, the factors affecting urban and spatial change are technology, social media, advanced industry, and artificial intelligence. Futurist cities stand out with notions of smart, sustainable, and participatory.

This design, which evokes the space age and developing technology, is defined as an approach that makes space more metallic and society more mechanical. In the study, triangular pyramids of different proportions were used to express the changes in different units of society, and with this method, it was aimed to capture unusual geometries. At the same time, each polyhedral module expresses the groups that will exist in society in the future and their living spaces.

Destructive Attitude Scenario

Destructive attitude can be considered positive or negative depending on the purpose it serves. For example, sometimes innovations occur due to some destructive attitudes, while destructive attitudes against the order can be considered creative at the same time and to the same degree. However, often, destructive attitudes are identified with negativities committed against the city and humanity such as war, refugees, natural disasters, disinformation, and nature destruction. From this point of view, the negative aspects of the destructive attitude in the design are expressed with fragmented, broken modules, while the positivities are expressed with a single pointed-faced module seen on the monolithic top. Thus, chaos, destruction, and re-existence are constructed together in the design.

Figure 3. Attitude towards the city scenarios and designs

6. CONCLUSION

Basic design education, which constitutes the infrastructure of design-based departments in our country, is considered a process that enables City and Regional Planning students to develop both the ability of visual thinking and the mindset to perceive the problem correctly and to choose the right information by capturing simplicity in many stimuli. The fact that students enter into a course that is very different from their educational background as well as their mindset they have until this period makes basic design education even more challenging for them. In recent years, as a result of the criticism that basic design education and abstract thinking structure are disconnected from other stages of vocational education, new searches are being made in basic design education. It is very important not to lose the traditions and teachings from the past and to use design more effectively to solve increasingly complex problems in the modern world.

In order to minimize the theoretical and practical problems, this study is designed as a transition project from the basic design process, which starts with abstraction and Euclidean geometry and leads to reading geometries in nature, to urban planning. Thus, students are prepared to be more perceptually competent in modeling the city with more complex systems and focusing on basic problems in the second-semester curriculum after the final project.

In terms of personal development, the study contributes to students expressing themselves, making detailed research (presentation) on a subject, and increasing their sociability with group work. From a professional point of view, it provides gains such as moving two-dimensional drawings to the third dimension, developing abstraction-concretization skills, expanding design perception and ability, addressing problems in the city, and revealing underprivileged groups and threats to the city. In addition to this, the students addressed each part of the city theoretically and carried out a successful workshop on how each of them can be modeled with mathematical values. Some of the students were able to take the work further and produce a fractal module based on polyhedrons.

With the application of geometric forms expressing the attitudes of individuals towards the city, students learned the importance of abstraction and geometry at the thought phase of design and experienced the application of these concepts in professional examples. In addition, enabling students to combine theory and practice in basic design and directing

the design in line with their views increased their ownership of their projects and reinforced their professional belonging.

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